What is claimed is:

1. A solid catalyst for ethylene polymerization, which uses, as magnesium halide source, a magnesium compound represented by a formula $(RMgX)_p(MgX_2)_q$, in which R is an alkyl group having from 3 to 12 carbon atoms, X is halogen, and molar ratio of q to p is in the range of from larger than 0 to 1.

2. The solid catalyst for ethylene polymerization as claimed in claim 1, characterized in that the molar ratio of q to p is in the range of from 0.05 to 0.95.

3. The solid catalyst for ethylene polymerization as claimed in claim 1, characterized in that X in the magnesium compound is chlorine.

4. A process for preparing the catalyst for ethylene polymerization as claimed in claim 1, characterized in that said process comprises the steps of:

(1)reacting powdered magnesium with an alkyl halide of formula RX in an ether solvent to form a magnesium compound having a structure represented by formula $(RMgX)_p(MgX_2)_q$, in which R is an alkyl group having from 3 to 12 carbon atoms, X is halogen, and molar ratio of q to p is in the range of from larger than 0 to 1, wherein the molar ratio of the powdered magnesium to the alkyl halide is from 1: 1 to 1:3;

(2)impregnating the magnesium compound onto silica carrier and drying to give silica loading the magnesium compound, wherein the silica is used in such an amount that per gram silica loads from 0.5 to 5.0mmol of magnesium element;

(3)reacting the silica loading the magnesium compound as prepared in step (2) with an alkyl halide of formula R^1X, in which R^1 is an alkyl group having from 3 to 12 carbon atoms and X is halogen, in an alkane solvent to give a product, wherein the alkyl halide is used in such an amount that the molar ratio of Mg in the magnesium compound to the alkyl halide is in the range from 1: 1 to 1:10;

(4)reacting the product obtained from step (3) with a titanium compound and an alkyl aluminum compound to form a main catalyst component, wherein the titanium compound has a structure represented by formula $Ti(OR^2)_mCl_{4-m}$, where R^2 is an alkyl group having from 1 to 4 carbon atoms and m is from 0 to 4, and the titanium compound is used in such an amount that the molar ratio of the Mg in the magnesium compound to the Ti in the titanium compound is in the range from 1:0.15 to 1:2.5, and wherein the alkyl aluminum compound has a structure represented by formula $R^3_nAlCl_{3-n}$, where R^3 is an alkyl group having from 1 to 14 carbon atoms and n is from 1 to 3, and the alkyl aluminum compound is used in such an amount that the molar ratio of the Mg in the magnesium compound to the Al in the alkyl aluminum compound is in the range from 1: 0.08 to 1:3; and

(5)contacting the main catalyst component with a cocatalyst component to form the catalyst for ethylene polymerization, wherein the cocatalyst component is an organo-aluminum compound, and the molar ratio of the Ti in the main catalyst component to the Al in the cocatalyst component is in the range from 1: 30 to 1:300.

5. The process according to claim 4, characterized in that the molar ratio of q to p is in the range of from 0.05 to 0.95.

6. The process according to claim 4, characterized in that X in the magnesium compound is chlorine.

7. The process according to claim 4, characterized in that the ether solvent is aliphatic hydrocarbyl ethers, aromatic hydrocarbyl ethers or cyclic ethers.

8. The process according to claim 7, characterized in that the ether solvent is diethyl ether, di-n-propyl ether, di-n-butyl ether, di-isobutyl ether, diphenyl ether, methyl phenyl ether, tetrahydrofuran, or mixture thereof.

9. The process according to claim 4, characterized in that the organo-aluminum compound is triethyl aluminum, diethyl aluminum chloride, triisobutyl aluminum, tri-n-hexyl aluminum, or mixture thereof.

10. The process according to claim 4, characterized in that the alkyl halide of formula RX and formula R^1X is an alkyl chloride.

11. The process according to claim 10, characterized in that the alkyl halide of formula RX and formula R^1X is independently chloropropane, chloro-n-butane, isobutyl chloride, isopentyl chloride or mixture thereof.

12. The process according to claim 4, characterized in that the titanium compound is titanium tetrachloride, tetrabutyl titanate, methoxy titanium trichloride, butoxy titanium trichloride, or mixture thereof.

13. The process according to claim 4, characterized in that the alkyl aluminum compound is triethyl aluminum, triisopropyl aluminum, triisobutyl aluminum, tri-n-hexyl aluminum, tri-n-octyl aluminum, tri(2-ethylhexyl) aluminum, diethyl aluminum chloride, ethyl aluminum dichloride, diisopropyl aluminum chloride, ethyl aluminum sesquichloride, butyl aluminum sesquichloride, or mixture thereof.

14. The process according to claim 4, characterized in that the alkane solvent is an paraffin hydrocarbon.

15. The process according to claim 14, characterized in that the alkane solvent is isopentane, hexane, n-heptane, octane, nonane, decane, or mixture thereof.

16. A process for preparing the catalyst for ethylene polymerization as claimed in

claim 1, characterized in that said process comprises the steps of:

(1)reacting powdered magnesium with an alkyl halide of formula RX in an ether solvent to form a magnesium compound having a structure represented by formula $(RMgX)_p(MgX_2)_q$, in which R is an alkyl group having from 3 to 12 carbon atoms, X is halogen, and molar ratio of q to p is in the range of from larger than 0 to 1, wherein the molar ratio of the powdered magnesium to the alkyl halide is in the range from 1: 1 to 1:3;

(2)impregnating the magnesium compound onto silica carrier and drying to give silica loading the magnesium compound, wherein the silica is used in such an amount that per gram silica loads from 0.5 to 5.0mmol of magnesium element;

(3)reacting the silica loading the magnesium compound as prepared in step (2) with a titanium compound and an alkyl aluminum compound to give a product, wherein the titanium compound has a structure represented by formula $Ti(OR^2)_mCl_{4-m}$, where R^2 is an alkyl group having from 1 to 4 carbon atoms and m is from 0 to 4, and the titanium compound is used in such an amount that the molar ratio of the Mg in the magnesium compound to the Ti in the titanium compound is in the range from 1:0.15 to 1:2.5, and wherein the alkyl aluminum compound has a structure represented by formula $R^3{}_nAlCl_{3-n}$, where R^3 is an alkyl group having from 1 to 14 carbon atoms and n is from 1 to 3, and the alkyl aluminum compound is used in such an amount that the molar ratio of the Mg in the magnesium compound to the Al in the alkyl aluminum compound is in the range from 1: 0.08 to 1:3;

(4)reacting the product obtained from step (3) with an alkyl halide of formula R^1X, in which R^1 is an alkyl group having from 3 to 12 carbon atoms and X is halogen, in an alkane solvent to form a main catalyst component, wherein the alkyl halide is used in such an amount that the molar ratio of Mg in the magnesium compound to the alkyl halide is in the range from 1: 1 to 1:10; and

(5)contacting the main catalyst component with a cocatalyst component to form the catalyst for ethylene polymerization, wherein the cocatalyst component is an organo-aluminum compound, and the molar ratio of the Ti in the main catalyst

component to the Al in the cocatalyst component is in the range from 1: 30 to 1:300.

17. Use of the catalyst as claimed in claim 1 in the polymerization of ethylene.

18. The use as claimed in claim 17, characterized in that the main catalyst component is suspended in a mineral oil to form a slurry for the polymerization of ethylene, and said main catalyst component comprises from 20 to 30 percent by weight of the slurry.